

**"IMPROVEMENTS IN A MODULAR FRUIT JUICE EXTRACTION
SYSTEM and CONFIGURATION FOR A SELF-CLEANING FILTER FOR
THE EXTRACTION OF FRUIT JUICE"**

5 This application is a continuation-in-part
application of previous applications by the same inventor
bearing:

10 1) U.S. Serial No. 08/647,066 filed May 9, 1996,
(which claims priority, under 35 U.S. Code § 119 based on
Brazilian Application No. PI-9502244-9 filed June 19,
1995), now U.S. Patent No, 5,655,441 issued August 12,
1997;

15 2) U.S. Serial No. 08/681,627 filed July 29, 1996,
(which claims priority, under 35 U.S. Code § 119 based on
Brazilian Application No. MI-5501198-5 filed August 1,
1995) now U.S. Patent No, 5,720,218 issued February 24,
1998;

20 3) U.S. Serial No. 08/681,626 filed July 29, 1996,
(which claims priority, under 35 U.S. Code § 119 based on
Brazilian Application No. MU-7501779-2 filed August 1,
1995);

4) U.S. Serial No. 08/759,723 filed December 6,
1996, (which claims priority, under 35 U.S. Code § 119
based on Brazilian Application No. MU-7502784-4 filed
December 8, 1995);

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5) U.S. Serial No. 08/759,722 filed December 6, 1996, (which claims priority, under 35 U.S. Code § 119 based on Brazilian Application No. MU-7502785-2 filed December 8, 1995) now U.S. Patent No, 5,720,219 issued
5 February 24, 1998;

6) U.S. Serial No. 08/759,727 filed December 6, 1996, (which claims priority, under 35 U.S. Code § 119 based on Brazilian Application No. MU-7502786-0 filed December 8, 1995);

10 7) U.S. Serial No. 08/763,679 filed December 11, 1996, (which claims priority, under 35 U.S. Code § 119 based on Brazilian Application No. MU-7502994-4 filed December 15, 1995);

15 8) U.S. Serial No. 08/884,529 filed June 27, 1997, (which claims priority, under 35 U.S. Code § 119 based on Brazilian Applications No. PI-9502218-0 filed June 12, 1995; No. PI-9502244-9 filed June 19, 1995; No. MI-5501197-7 filed August 1, 1995; No. MI-5501198-5 filed August 1, 1995; No. MI-5501199-3 filed August 1, 1995;
20 No. MU-7501779-2 filed August 1, 1995; No. MU-7501780-6 filed August 1, 1995; No. MU-7501781-4 filed August 1, 1995; No. PI-9503518-4 filed August 1, 1995; No. MU-7501563-3 filed August 7, 1995; No. PI-9503109-0 filed

and,

11) U.S. Serial No. 09/377,937 filed August 20, 1999, (which claims priority, under 35 U.S. Code § 119 based on all of the applications in Items 1 - 9 above).

5 The entirety of these previous applications are incorporated herein by reference as if set forth in full below.

10 The present patent of invention refers to both "IMPROVEMENTS IN A MODULAR FRUIT JUICE EXTRACTION SYSTEM and CONFIGURATION FOR A SELF-CLEANING FILTER FOR THE EXTRACTION OF FRUIT JUICE." For "IMPROVEMENTS IN A MODULAR FRUIT JUICE EXTRACTION SYSTEM" or be it, as the nomenclature implies, a system developed with the purpose of obtaining juice from citrus fruit such as orange, 15 grapefruit, lemon, lime, tangerine, mekan, pokan, etc., and other round or near-round non-citrus fruit. The important characteristics of the present system includes: compactness, modularity, durability, simplicity and the highest quality of the juice obtained form extraction. 20 For "CONFIGURATION FOR A SELF-CLEANING FILTER FOR THE EXTRACTION OF FRUIT JUICE" or more fully, "IMPROVED CONFIGURATION FOR A SELF-CLEANING FILTER WITH REMOVABLE PERFORATING POINT FOR THE EXTRACTION OF FRUIT JUICE," or

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be it, as the nomenclature implies, a cylindrical filter constructed of stainless steel or other food grade, nontoxic materials developed with the purpose of obtaining juice from citrus fruit such as orange, grapefruit, lemon, lime, tangerine, mekan, pokan, etc., and other round or near-round non-citrus fruit. The important characteristics of the present configuration includes: better filtration efficiency, greater juice yield as well as increased self-cleaning and sanitization characteristics obtained due to its design, compactness and simplicity thus contributing further to increase juice quality and juice yield as obtained in fruit juice extraction processes.

THE STATE OF THE ART

The state of the art is known from previous patents by the same inventor, including US Patent 5,655,441, Patent 5,720,218, Patent 5,720,219 and Patent 5,802,964, which revolutionized the market by introducing a method of juice extraction which eliminated the traditionally bitter tastes in citrus juices, by eliminating the contact of peel with the juice being extracted.

This equipment primarily based its advantages in the process of peeling the fruit before juice extraction, by

means of a fixed peeler cup (concave and radially cut hemisphere) and by meshing with an identical movable peeler cup (concave and radially cut hemisphere), which in their relative motion act together to shear the peel in longitudinal strips. Immediately after, the core of the fruit enters a filtering device which allows juice to pass through its radially cut slits, and is collected into a juice collector which has an lower side opening on one of its ends, so that it allows the juice to, by gravity, flow into a collecting juice tank. The dried fruit core is then pushed, by a plunger, back in the direction of the filter's opening, in a manner that expels the core completely, allowing the core to drop vertically through the peeler cups and into the peel and core reservoir or transport devices.

In the above described fruit juice extraction process, cylindrical filters with radial slits are used. These filters include at their front end a sharp knife-edged cylindrical cutting point that perforates the fruit at a point in the compression stage of said fruit, permitting that shearing of the fruit peel can be achieved while simultaneously transforming the fruit from its hemispherical shape into peelings, and permitting

The quality and organoleptic characteristics of the juice extracted is maintained as described in the original patents, and greatly improved in relation to older technologies, be it those of small, medium or large scale machinery. The high degree of modularity, and therefore scaleability, is an important benefit of the invention here proposed, as it facilitates and permits growth of productivity on a modular basis, allowing for an initial single module to be used and permitting that, over time, many, perhaps 100 or more, modules can be installed in juice production facilities, permitting flexible and economic growth of one's juice production plant. This is an important feature of this invention because this permits smaller scale juice production facilities to grow to extremely large, multi-million-gallon per year juice plants, and, independently of size or production capabilities, to gain the advantages of the quality and organoleptic improvements in the juice extracted.

In general terms, the objective of this invention is a concept of a machine composed of two pairs of peeler cups where for each fixed peeler cup, attached to the basic structure of the machine, and an equivalent and

matching moveable peeler cup is fixed to opposite ends of
a single linear actuator that drives, in a back and forth
cycle, both movable peeler cups. In this configuration,
the system is composed of a single moveable peeler cup at
5 each of the extreme ends of the linear actuator, driven
in a manner that one maximizes the utilization and
productivity of the drive motion, since as one moveable
peeler cup is opening to allow a fruit to fall within its
concave and radially cut chamber, formed in conjunction
10 with its matching fixed peeler cup, the moveable peeler
cup at the opposite end is closing upon the fruit inside
the chamber and shearing the fruit's skin as it initiates
the peeling process and continues on to complete the
juicing cycle by pumping the fruit's core into the
15 filtering device. This configuration therefore permits
significant economies of space, complexity, weight,
energy and costs, and assures a simple basic modular unit
for use in multiple numbers, limited only by the desired
juice production capacity, which varies greatly from
20 customer to customer.

By utilizing a simple linear actuator concept for
driving the moveable peeler cups, one can employ various
drive technologies, including hydraulic, pneumatic,

electric, geared, screw and/or any combination of known linear drive systems. Since the drive movement is restricted to a simple linear back and forth action, one can assure greater simplicity of construction and therefore greater reliability, less energy consumption, lower weight and lower manufacturing costs with this invention, as compared to older nonlinear actuation systems that employ, cams, cam followers, gearboxes, electrical motors, levers, springs, and other complicated, more numerous and less reliable and more costly devices and systems.

The present invention in "CONFIGURATION FOR A SELF-CLEANING FILTER FOR THE EXTRACTION OF FRUIT JUICE" maintains the primary characteristics of the original patents, nevertheless, its objective is to propose a simple and unique configuration that improves filtration performance and adds to operational flexibility, increases filter life and contributes significantly to improving the cost/benefit and economic performance of this important component in the fruit juice extraction process. The quality and organoleptic characteristics of the juice extracted is maintained as described in the original patents, and greatly improved in relation to

older technologies, be it those of small, medium or large scale machinery.

To generate the improvements describe above, the present invention proposes a configuration that consists
5 of a removable cylindrical perforating cutting edge which is attached, by threads or other methods, to a main cylindrical body of the filter which has a multitude of transverse radial slits with conical, or V-shaped, formats. These conically shaped transverse radial slits
10 are positioned parallel with respect to each other and, can be spaced and sized variably, dependent on the juice product desired to be produced. The proposed invention functions by first perforating the fruit's peel in a manner such that ^{it} permits the pumping action of a moveable peeler cup (a concave and radially cut hemisphere) to
15 force a core section of fruit to enter completely into said filter, where simultaneously, due to the high pressure generated by the action, the juice is forced to flow through the multitude of conically shaped transverse radial slits that are positioned parallel with respect to
20 each other, thus separating and filtering the liquid juice from solid components of the fruit. The removable cylindrical perforating cutting edge simplifies

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replacement and permits for interchangeability with differently shaped cutting edges which can vary as desired in order to obtain better juice extraction performance on the many varieties of citrus and other fruit.

Other important improvements obtained from this invention are greater efficiency and yield in juice extraction, as a function of the conical, or V-shaped, profile of the multiple transverse radial slits, since this shape generates a greater pressure differential between the inside and outside portions of the filter, in fact, inducing a "Venturi Effect" which accelerates fluid flow from the inside to the outside of the filter, thus promoting greater juice yield and greater productivity and helping greatly to maintain these passageways clear of obstructions and reducing clogging and cleaning frequency.

ADDITIONAL CONFIGURATIONS

The present invention in "IMPROVEMENTS IN A MODULAR FRUIT JUICE EXTRACTION SYSTEM" contemplates various interchangeable versions or embodiments of detailed configurations, differences mostly are related to the peeler cups, expulsion of the fruit's core through one of

the peeler cups, actuation of the plunger and its function to expel the fruit's dried core, after the juice has been extracted and filtered. A first version or the preferred embodiment is configured in a manner such that

5 the plunger is driven by two linear actuators mounted parallel to the main peeler cup actuator, so that when driven, these two linear actuators will pull on in-line rods that are attached to a cross member which is fixed to the plunger so that the plunger will move linearly

10 inside the filtering device, pushing the fruit's core until it has reached the opening of the filter and overshooting until the core is totally expelled and permitted to fall vertically within, and through the peeler cups, and finally dropping into the core receiving

15 duct.

In a second embodiment or version, the machine is configured in a manner such that the plunger is driven by the returning motion of the moveable peeler cup itself, since the in-line pull rods are attached to the cross

20 members that hold the moveable peeler cups, and as the machine is cycled normally through its back and forth motion, the in-line rods, that are attached to a cross member which is fixed to the plunger, will drive the

plunger to move linearly inside the filtering device,
pushing the fruit's core until it has reached the opening
of the filter and overshooting until the core is totally
expelled and permitted to fall vertically within and
5 through the peeler cups and, finally dropping into the
core receiving duct.

In another embodiment or version, the plunger is
driven in same manner as twice described before above,
but the drive is provided by direct force being applied
10 to the plunger by independent linear actuators mounted
directly on the machine's basic structure, one at each of
the opposite extreme ends of said machine.

In a third embodiment or version, the expulsion of
the fruit's core is through the back side of the movable
15 peeler cup.

In a fourth embodiment or version, the expulsion of
the fruit's core through the back side of an internal
movable peeler cup.

DRAWINGS:

BRIEF DESCRIPTION OF THE DRAWING

20 The invention will be described in the following
attached drawing figures, which will illustrate details
including:

FIGURE 1: A side cross-sectional view of the

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invention, as described before, in its first or preferred
embodiment or version, showing, on the left side, a
moveable peeler cup in the full open position, as well as
the expulsion of the fruit's core and its falling into
5 the fruit core collector duct, as well as the vertical
falling of the sheared peeled skins. On the right side,
one can observe the closed position of the moveable
peeler cup, fully engaged with the fixed peeler cup, as
well as the juice being filtered through the filtering
10 device while the fruit's core remains inside the filter
itself at this point in the extraction cycle. Also shown
is the juice being collected in the juice collection
chamber, sheared peel skin strips falling vertically down
and, finally, dried fruit cores falling further through
15 the fruit core receiving duct, in a manner that all of
the byproducts being produced can now be directed
respectively to other stages of processing;

FIGURE 2: A top view of the embodiment of the
invention of FIGURE 1 taken along the LINE A-A (or "VISTA
A-A") of FIGURE 1;

FIGURE 3: A front view of the invention of
FIGURE 1 ;

FIGURE 4: A side cross-sectional view of the

invention, as described before, in its second embodiment
or version, showing, on the left side, a moveable peeler
cup in the full open position, as well as the expulsion
of the fruit's core and its falling into the fruit core
5 collector duct, as well as the vertical falling of the
sheared peeled skins. On the right side, one can observe
the closed position of the moveable peeler cup, fully
engaged with the fixed peeler cup, as well as the juice
being filtered through the filtering device while the
10 fruit's core remains inside the filter itself at this
point in the extraction cycle. Also shown is the juice
being collected in the juice collection chamber, sheared
peel skin strips falling vertically down and, finally,
dried fruit cores falling further through the fruit core
15 receiving duct, in a manner that all of the byproducts
being produced can now be directed respectively to other
stages of processing;

FIGURE 5: A top view of the invention, in its
second embodiment or version of FIGURE 4 taken along the
20 LINE ⁵⁻⁵ ~~A-A (or "VISTA A-A")~~ of FIGURE 4. The third
embodiment or version is NOT SHOWN in the drawing;

FIGURE 6: A partial perspective view of the
main body the filter showing the conical section

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transverse radial slits and the removable cylindrical perforating cutting edge as attached to the main body of said filter;

FIGURE 7: A side view of the filter showing the
5 conical section transverse radial slits and the removable cylindrical perforating cutting edge as attached to the main body of said filter;

FIGURE 8: A typical cross sectional view of the main body of the filter;

10 FIGURE 9: A longitudinal cross sectional segment view of the main body of the filter showing the conical, or V-shaped, nature of the transverse radial slits through which the juice flow through;

FIGURE 10: A side cross-sectional view of the
15 invention, as described before, in its third embodiment or version, showing, on the left side, a moveable peeler cup in the full open position, as well as the expulsion of the fruit's core through the back side of the movable peeler cup and its falling into the fruit core collector
20 duct, as well as the vertical falling of the sheared peeled skins. On the right side, one can observe the closed position of the moveable peeler cup, fully engaged with the fixed peeler cup, as well as the juice being

filtered through the filtering device while the fruit's core remains inside the filter itself at this point in the extraction cycle. Also shown is the juice being collected in the juice collection chamber, sheared peel skin strips falling vertically down and, finally, dried fruit cores falling further through the fruit core receiving duct, in a manner that all of the byproducts being produced can now be directed respectively to other stages of processing;

10 FIGURE 11: A top view of the embodiment of the invention of FIGURE 10 taken along the LINE 11 - 11 of FIGURE 10;

15 FIGURE 12: A side cross-sectional view of the invention, as described before, in its fourth embodiment or version, showing, on the left side, external and internal moveable peeler cups in the full open position, as well as the expulsion of the fruit's core through the back side of the internal movable peeler cups and its falling into the fruit core collector duct, as well as
20 the vertical falling of the sheared peeled skins. On the right side, one can observe the closed position of the moveable peeler cup, fully engaged with the fixed peeler cup, as well as the juice being filtered through the

filtering device while the fruit's core remains inside the filter itself at this point in the extraction cycle. Also shown is the juice being collected in the juice collection chamber, sheared peel skin strips falling vertically down and, finally, dried fruit cores falling further through the fruit core receiving duct, in a manner that all of the byproducts being produced can now be directed respectively to other stages of processing; and,

FIGURE 13: A top view of the embodiment of the invention of FIGURE 12 taken along the LINE 13 - 13 of FIGURE 12.

DETAILED DESCRIPTION OF THE INVENTION

The "IMPROVEMENTS IN A MODULAR FRUIT JUICE EXTRACTION SYSTEM," object of this application for patent of invention, consists essentially of a modular system shown in four optional and functionally interchangeable embodiments or versions, which vary in the drive configuration of the plunger, its function being to expel the dried fruit core and, in so doing, clear the way for receiving a new fruit to be juiced; and the means for expelling the fruit's core through the back side of a movable peeler cup.

In the first or preferred embodiment or version, best seen in FIGURES 1 - 3, a linear actuator (2) drives moveable peeler cups (4) (concave and radially cut hemispheres), be it by hydraulic, pneumatic, screw, electrical or other linear motion drive device, in a manner such that the moveable peeler cup (4) at one end of the machine is closing in relation to the fixed peeler cup (3) at the same end, while the other peeler cup (4), at the opposite end of the first, is opening with respect to its matching fixed peeler cup (3). In so doing, and by the nature of the back and forth motion of the linear drive device, there is a doubling of the productivity of the machine cycle. The machine cycle encompasses the linear movement of the two moveable peeler cups (4), each attached to one of the two extreme ends of the linear actuator (2) and guided linearly by the guide rails (17) which slide on bearing seats (18) mounted transversely and coincidentally with each other, being that the moveable peeler cups (4) move in the direction of the fixed peeler cups (3) which in turn are firmly attached to a structural chassis (1), while the motion of said moveable peeler cups (4) is solidly transmitted to vertical rods (6), in a synchronized manner such that

these vertical rods will touch and initiate a linear dislodging of the feeder mechanism's spring (5), thus allowing one of the fruit (19) to drop through the feeder duct and into the chamber formed by the intermeshing of the moveable peeler cup (4) and its matched pair fixed peeler cup (3).

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10 In continuation of the extraction cycle, the fruit (19) now held in the chamber formed by the intermeshing of the moveable peeler cup (4) and its matched pair fixed peeler cup (3), is then pressed by the moveable peeler cup (4) into the fixed peeler cup (3), since both have multiple radially cut openings, the action causes the skin of the fruit to be sheared in multiple strips (12) which pass through the peeler cups' radial openings and fall vertically, while the fruit's core (13) is taken inside the filtering device (7 or F) since this filtering device has a circular sharp cutting point at its forward opening, permitting the fruit's core (13) to enter completely into the filter (7), which has radially cuts slits which allow for the extracted juice (11) to flow through and be collected in the space formed by the inside of the fixed peeler cup (3) and the juice collector (10).

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In the final stages of the extraction cycle, as the moveable peeler cups (4) move back and away from the fixed peeler cups (3), linear actuators (16) drive the pull rods (15) which in turn are attached to a transverse cross member (9) to which the plunger (8) is firmly fixed, thus driving said plunger (8) to travel through the filter and to push directly on the fruit's core (13) until said core is expelled completely from the forward end of the filter and, finally, the dried fruit core falls into and through the chamber formed by the fixed (3) and moveable (4) peeler cups, and is directed to further fall through the fruit core receiving duct (14), in a manner so that all of the by-products being produced: juice (11 or J), peel (12 or P) and core (13 or C), can now be directed respectively to other stages of processing. With the moveable peeler cup (4) in the full open position, the machine is ready to commence another fruit juice extraction cycle. Given that the geometry and configuration is as shown, one can see that the pair of peeler cups (3) and (4) at one end of the machine will be exactly 180 degrees out of phase with respect to the pair of peeler cups at the opposite end of said machine. At either end of the machine, or, at either pair of peeler

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cups, the juice extraction cycle is exactly identical and fully described above.

In the second embodiment or version of this invention, there is an alternate way of driving the plunger (8), but the fruit juice extraction cycle is the same as in the first version described above. As shown in FIGURES 4 and 5, a linear actuator (2) drives two moveable peeler cups (4), each attached to one of the two extreme ends of the linear actuator (2) and guided linearly by the guide rails (17) which slide on bearing seats (18) mounted transversely and coincidentally with each other, being that the moveable peeler cups (4) move in the direction of the fixed peeler cups (3) which in turn are firmly attached to a structural chassis (1), while the motion of said moveable peeler cups (4) is solidly transmitted to vertical rods (6), in a synchronized manner such that these vertical rods will touch and initiate a linear dislodging the feeder mechanisms spring (5), thus allowing one of the fruit (19) to drop through the feeder duct and into the chamber formed by the intermeshing of the moveable peeler cup (4) and its matched pair fixed peeler cup (3). In continuation of the extraction cycle, the fruit (19) now

held in the chamber formed by the intermeshing of the
 moveable peeler cup (4) and its matched pair fixed peeler
 cup (3), is the pressed by the moveable peeler cup (4)
 into the fixed peeler cup (3), since both have multiple
 5 radially cut openings, the action causes the skin of the
 fruit to be sheared in multiple strips (12) which pass
 through the peeler cups radial openings and fall
 vertically, while the fruit's core (13) is taken inside
 the filtering device (7) since this filtering device has
 10 a circular sharp cutting point at its forward opening,
 permitting the fruit's core to enter completely into the
 filter (7), which has radially cuts slits which allow for
 the extracted juice (11) to flow through and be collected
 in the space formed by the inside of the fixed peeler cup
 15 (3) and the juice collector (10). In the final stages of
 the extraction cycle, driven by the action of linear
 actuator (2), the moveable peeler cup (4) moves back and
 away from the fixed peeler cup (3), and since it is
 solidly fixed to a transverse cross member (20), causes
 20 the simultaneously driving of said cross member (20),
 which in turn is attached through the pull rods (15) to
 another transverse cross member (9) at the opposite end,
 to which plunger (8) is firmly fixed, thus driving said

plunger (3) to travel through the filter and push directly on the fruit's core (13) until said core is expelled completely from the forward end of the filter (7) and, finally, the dried fruit core (13) falls into and through the chamber formed by the fixed (3) and moveable (4) peeler cups, and is directed to further fall through the fruit core receiving duct (14), in a manner so that all of the byproducts being produced: juice (11), peel (12) and core (13), can now be directed respectively to other stages of processing. With the moveable peeler cup (4) in the full open position, the machine is ready to commence another fruit juice extraction cycle. Given that the geometry and configuration is as shown, one can see that the pair of peeler cups (3) and (4) at one end of the machine will be exactly 180 degrees out of phase with respect to the pair of peeler cups at the opposite end of said machine. At either end of the machine, or, at either pair of peeler cups, the juice extraction cycle is exactly identical and fully described above.

It can be understood that there is yet another manner of driving the plunger (8) (although NOT shown in FIGURES 1 - 5), that is by placing a linear actuator fixed directly to structural chassis (1) and attaching

the driving end of said actuator to plunger (8), one can drive said plunger (8) to travel through the filter (7) and push directly on the fruit's core (13) until said core is expelled completely from the forward end of the filter and, finally, the dried fruit core falls into and through the chamber formed by the fixed (3) and moveable (4) peeler cups, and is directed to further fall through the fruit core receiving duct (14), in a manner so that all of the byproducts being produced: juice (11), peel (12) and core (13), can now be directed respectively to other stages of processing. With the moveable peeler cup (4) in the full open position, the machine is ready to commence another fruit juice extraction cycle. Given that the geometry and configuration is as shown, one can see that the pair of peeler cups (3) and (4) at one end of the machine will be exactly 180 degrees out of phase with respect to the pair of peeler cups at the opposite end of said machine. At either end of the machine, or, at either pair of peeler cups, the juice extraction cycle is exactly identical and fully described above.

The invention also includes, in all configurations and versions, clean-in-place spray nozzles (21) mounted at different positions on structural chassis (1), in a

manner such that liquid and/or vaporized sprays can be utilized automatically, controlled by computer or other methods, for automatic cleaning of the machine at predetermined time periods as deemed necessary.

5 The "IMPROVED CONFIGURATION FOR A SELF-CLEANING
FILTER WITH REMOVABLE PERFORATING POINT FOR THE
EXTRACTION OF FRUIT JUICE," object of this application
for utility patent, consists of a cylindrical filtering
device such as device 7 or F of the invention in
10 "IMPROVEMENTS IN A MODULAR FRUIT JUICE EXTRACTION SYSTEM"
illustrated in FIGURES 1 - 5. Device 7, best seen in
FIGURES 6 - 9, has a filter body (51) constructed of
stainless steel or other food grade, nontoxic materials
developed with the purpose of obtaining high quality and
15 large quantities of juice from citrus fruit and other
round or near-round non-citrus fruit.

 The main body (51) of the filter is in a tubular
cylindrical shape where at one extreme end a removable
cylindrical perforating cutting edge (52) is attached, by
20 threads or other methods, and is constructed so as to
terminate in a sharp knife edged circular point (53),
which functions by first perforating the fruit's peel in
a manner such that permits the pumping action of a

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moveable peeler cup (6) (a concave and radially cut hemisphere) to force a core section (13 or C) of fruit to enter completely into said filter (7 or F), where simultaneously, due to the high pressure generated by the action, the juice (11 or J) is forced to flow through the multitude of conically shaped transverse radial slits that are positioned parallel with respect to each other, thus separating and filtering the liquid juice (J) from solid components of the fruit's core (C).

10 The filter's main body (51) is of constant cylindrical shape with a removable cylindrical perforating cutting edge (52) attached at one extreme end of said main body (51), which in turn is configured to have a multitude of transverse radial slits (54) with
15 conical, or V-shaped, format, positioned parallel with respect to each other (55), and which can be spaced and sized variably, dependent on the juice (J) product desired to be produced. The nature and numbers of the multitude of transverse radial slits (54) with conical,
20 or V-shaped, generate greater efficiency and yield in juice extraction, since this shape generates a greater pressure differential between the inside and outside portions of the filter, in fact, inducing a "Venturi

Effect" which accelerates juice flow from the inside to the outside of the filter, thus promoting greater juice (J) yield and greater productivity by helping to maintain these passageways clear of obstructions and reducing clogging and cleaning frequency.

FIGURE 1 shows, as an example, a juice extraction machine, where one can observe the positioning of the self-cleaning filters (7 or F), object of this application for "IMPROVED CONFIGURATION FOR A SELF-CLEANING FILTER WITH REMOVABLE PERFORATING POINT FOR THE EXTRACTION OF FRUIT JUICE," where all byproducts of extraction, such as juice (J), extracted from the fruit's core (C) and peel skin strips (P) were obtained from the fruit (19 or R). Also shown in FIGURE 1, is the layout of the fruit bin placement as well as the fixed peeler cups (3) and moveable peeler cups (4) and the linear actuator (2) which drives the moveable peeler cups (4) against the fixed peeler cups (3) while simultaneously actuating the feeder spring (5) which permits the continuous and synchronized feeding of fruit (R) for juice (J) extraction.

In the third embodiment or version 100 (the 100 series is used to identify identical components to the

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first and second embodiments / unless a specific description is given, i.e., filtering device 107 is identical to filtering device 7), as best seen in FIGURES 10 - 11, a linear actuator (102) drives moveable peeler cups (104) (concave and radially cut hemispheres), be it by hydraulic, pneumatic, screw, electrical or other linear motion drive device, in a manner such that the moveable peeler cup (104) at one end of the machine is closing in relation to the fixed peeler cup (103) at the same end, while the other peeler cup (104), at the opposite end of the first, is opening with respect to its matching fixed peeler cup (103). In so doing, and by the nature of the back and forth motion of the linear drive device, there is a doubling of the productivity of the machine cycle. The machine cycle encompasses the linear movement of the two moveable peeler cups (104), each attached to one of the two extreme ends of the linear actuator (102) and guided linearly by the guide rails (117) which slide on bearing seats (118) mounted transversely and coincidentally with each other, being that the moveable peeler cups (104) move in the direction of the fixed peeler cups (103) which in turn are firmly attached to a structural chassis (101), while the motion

of said moveable peeler cups (104) is solidly transmitted to vertical rods (106), in a synchronized manner such that these vertical rods will touch and initiate a linear dislodging of the feeder mechanism's spring (105), thus
5 allowing one of the fruit (119) to drop through the feeder duct and into the chamber formed by the intermeshing of the moveable peeler cup (104) and its matched pair fixed peeler cup (103).

10 In continuation of the extraction cycle, the fruit (119) now held in the chamber formed by the intermeshing of the moveable peeler cup (104) and its matched pair fixed peeler cup (103), is then pressed by the moveable peeler cup (104) into the fixed peeler cup (103), since both have multiple radially cut openings, the action
15 causes the skin of the fruit to be sheared in multiple strips (112) which pass through the peeler cups' radial openings and fall vertically, while the fruit's core (113) is taken inside the filtering device (107) since this filtering device has a circular sharp cutting point
20 (such as point 53 of filtering device 7) at its forward opening, permitting the fruit's core (113) to enter completely into the filter (107), which has radially cuts slits which allow for the extracted juice (111) to flow

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through and be collected in the space formed by the
inside of the fixed peeler cup (103) and the juice
collector (110).

In the final stages of the extraction cycle, as the
5 moveable peeler cups (104) move back and away from the
fixed peeler cups (103), linear actuators (116) drive the
pull rods (115, 169) which in turn are attached to a
transverse cross member (109) to which the plunger (108)
is firmly fixed, thus driving said plunger (108) to
10 travel through the filter and to push directly on the
fruit's core (113) until said core is expelled completely
from the forward end of the filter and, finally, the
dried fruit core is forced (by a following core) through
the chamber (145) positioned at the inner or back end of
15 moveable peeler cup (104), and is directed to further
pass through the fruit core receiving duct (114) which is
integral with core chamber (145) and angulated downwardly
so that the fruit's core (113) can actually fall under
the force of gravity through the duct (114), in a manner
20 so that all of the by-products being produced: juice
(111), peel (112) and core (113), can now be directed
respectively to other stages of processing. With the
moveable peeler cup (104) in the full open position, the

machine is ready to commence another fruit juice extraction cycle. Given that the geometry and configuration is as shown, one can see that the pair of peeler cups (103) and (104) at one end of the machine will be exactly 180 degrees out of phase with respect to the pair of peeler cups at the opposite end of said machine. At either end of the machine, or, at either pair of peeler cups, the juice extraction cycle is exactly identical and fully described above.

Embodiment 100 also includes clean-in-place spray nozzles (121) mounted at different positions on structural chassis (101), in a manner such that liquid and/or vaporized sprays can be utilized automatically, controlled by computer or other methods, for automatic cleaning of the machine at predetermined time periods as deemed necessary.

In the fourth embodiment or version 200 (the 200 series is used to identify identical components to the first through third embodiments unless a specific description is given, i.e., filtering device 207 is identical to filtering devices 7 and 107), as best seen in FIGURES 12 - 13, a linear actuator (202) drives both external moveable peeler cups (203) and internal moveable

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peeler cups (204) (concave and radially cut hemispheres),
be it by hydraulic, pneumatic, screw, electrical or other
linear motion drive device, in a manner such that the
internal moveable peeler cup (204) at one end of the
5 machine is closing in relation to the external movable
peeler cup (203) at the same end, while the other
internal movable peeler cup (204), at the opposite end of
the first, is fully closed with respect to its matching
external movable peeler cup (203). In so doing, and by
10 the nature of the back and forth motion of the linear
drive device, there is enhanced productivity of the
machine cycle. The machine cycle encompasses the linear
movement of the two internal moveable peeler cups (204),
each attached to one of the two extreme ends of the
15 linear actuator (202) and guided linearly by the guide
rails (217) which slide on bearing seats (218) mounted
transversely and coincidentally with each other, being
that the internal moveable peeler cups (204) move in the
direction of the external moveable peeler cups (203)
20 which in turn have linear movement as each attached to
one of the two extreme ends of the linear actuator (202)
and guided linearly by the secondary guide rails (224)
which slide on secondary bearing mounts (225) mounted

transversely and coincidentally with each other and are
firmly attached to a structural chassis (201), while the
motion of said moveable peeler cups (203, 204) is solidly
transmitted to vertical rods (206), in a synchronized
5 manner such that these vertical rods will touch and
initiate a linear dislodging of the feeder mechanism's
spring (205), thus allowing one of the fruit (219) to
drop through the feeder duct and into the chamber formed
by the intermeshing of the internal moveable peeler cup
10 (204) and its matched pair external moveable peeler cup
(203).

In continuation of the extraction cycle, the fruit
(219) now held in the chamber formed by the intermeshing
of the internal moveable peeler cup (204) and its matched
15 pair external moveable peeler cup (203), is then pressed
by the internal moveable peeler cup (204) into the
external moveable peeler cup (203), since both have
multiple radially cut openings, the action causes the
skin of the fruit to be sheared in multiple strips (212)
20 which pass through the peeler cups' radial openings and
fall vertically, while the fruit's core (213) is taken
inside the filtering device (207) since this filtering
device has a circular sharp cutting point (such as point

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53 of filtering device 7) at its forward opening, permitting the fruit's core (213) to enter completely into the filter (207) which has radially cuts slits which allow for the extracted juice (211) to flow through and be collected in the space formed by the inside of the external moveable peeler cup (203) and the juice collector (210).

In the final stages of the extraction cycle, as the internal moveable peeler cups (204) move back and away from the external moveable peeler cups (203), linear actuator (202) drives the peeler cup supports (222, 223) which in turn are attached to a transverse cross member (209) to which the plunger (208) is firmly fixed, thus driving said plunger (208) to travel through the filter (207) and to push directly on the fruit's core (213) until said core is expelled completely from the forward end of the filter and, finally, the dried fruit core is forced (by a following core) through the chamber (245) positioned at the inner or back end of internal moveable peeler cup (204), and is directed to further pass through the fruit core receiving duct (214) which is integral with core chamber (245) and angulated downwardly so that the fruit's core (213) can actually fall under the force

of gravity through the duct (214), in a manner so that all of the by-products being produced: juice (211), peel (212) and core (213), can now be directed respectively to other stages of processing. With the internal moveable peeler cup (204) in the full open position, the machine is ready to commence another fruit juice extraction cycle. Given that the geometry and configuration is as shown, one can see that the pair of moveable peeler cups (203) and (204) at one end of the machine will be out of phase (but not by 180 degrees) with respect to the pair of peeler cups at the opposite end of said machine. At either end of the machine, or, at either pair of peeler cups, the juice extraction cycle is exactly identical and fully described above.

Embodiment 200 also includes clean-in-place spray nozzles (221) mounted at different positions on structural chassis (201), in a manner such that liquid and/or vaporized sprays can be utilized automatically, controlled by computer or other methods, for automatic cleaning of the machine at predetermined time periods as deemed necessary.

What is claimed as ^{my} invention is:

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